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Charges in POPC Monolayers - a Temperature Dependant Monolayer Study

Malgorzata Hermanowska[1], Goran Bijelic[2], Beate Klösgen[1], Per Claesson[2].
[1]University of Southern Denmark, Odense, Denmark, [2]Royal Institute of Technology, Stockholm, Sweden.

Abstract: The surface of a bio-membrane is the first site of interaction for many bio-physico-chemical processes. The access to the surface, and the local structural modifications induced to the lipid bilayer upon interaction with an adsorbing guest molecule must be influenced significantly by the presence of charges, and local changes in surface charge density. Here we present preliminary results from an isothermal compression study of POPC monolayers into which charges were inoculated by addition of the ethylated lipid variety. The phase state will be discussed in view of its relevance surface adsorption.
The phospholipids examined in this study are: 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphocholine (POPC) and 1-palmitoyl-2-oleoyl-sn-glycero-3-ethylphosphocholine (EPOPC). Charge effects on POPC monolayers at the air-water interface were investigated by addition of different percentages of the cationic EPOPC. These two phospholipids have the same molecular sequence apart from a slight difference in the headgroup region. The isotherms obtained for the mixtures are compared with pure POPC monolayer isotherms as a standard system.
Temperature dependence of the isotherms for both pure POPC and the different monolayer compositions were examined at temperatures ranging from 5°C to 50°C. The □-A isotherms for POPC exposed a behaviour which agrees well with established theoretical approaches for temperatures above 20°C: in that temperature region the surface pressure is increased as temperature is raised. However at temperatures lower than 20°C non-ideal behaviour is observed in that surface pressure increases again upon decrease in temperature. The minimum in surface pressure as a function of temperature is seen around 20°C. The increase in monolayer's surface pressure upon introduction of a surface charge indicates repulsive interaction between molecules, this might decrease stability of film thus, induce curvature frustration and might destabilize a bilayer formed from such a mixture.